Just Found

Researchers use a miniature machine to get more information about mouth bacteria.

What's in Your Mouth?

You might feel the urge to brush your teeth after reading this story.

That's because there are more than 700 different species of bacteria living in your mouth! Most of them are good, helping with digestion and other normal functions. But some cause problems like tooth decay.

Scientists already knew that our mouths are teeming with microbes, but until now they didn't know much more. That's because it's been impossible to grow most types of mouth bacteria in petri dishes, where researchers can look closely at them under a microscope.

Now, a microbiologist-physicist team from Stanford University has invented a clever way to identify and analyze these bacteria without culturing them.

David Relman and **Stephen Quake** built a miniature machine that retrieves and examines a single bacterium in a scraping from unbrushed teeth.

The device pumps tiny volumes of chemicals that burst the microbe, push its contents through a series of chambers, and then read the microbe's genetic material. This information identifies the bacterium and helps explain its role in maintaining health or causing illness. —*Alison Davis*

Chemists figure out how microbes create the smell of dirt.

Chemists Smell Dirt

The smell of freshly plowed soil can signal that winter's frozen grip is finally giving way to spring.

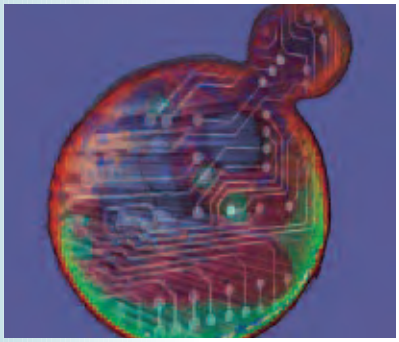
Like any odor, the smell of dirt is a volatile, or gaseous, molecule. After attaching itself inside the nose, an odor molecule sends an electrical signal to the brain, telling us what the smell is.

Scientists know that the odor of dirt is a molecule called geosmin (Greek for "earth odor") and that our noses are exquisitely sensitive to it. We can detect as few as five molecules of geosmin out of a trillion other molecules.

Researchers also know that bacteria and algae make geosmin in a two-step chemical reaction that breaks apart a larger molecule called a terpenoid.

Health researchers like Brown University chemist **David Cane** are interested in the chemistry of terpenoids because many of these substances are hormones, antibiotics, or other medically relevant molecules.

Cane recently discovered how bacteria and algae make geosmin. His findings should be useful to environmental and food chemists too, since geosmin can give drinking water, fish, and some vegetables a bad taste. —*A.D.*



CAROLYN LABABELL

A precisely controlled protein circuit in a yeast cell creates a simple form of "memory."

Molecule Memories

What if an organ could, by itself, "remember" what to do in an emergency? Could a lab-grown heart instantly repair damage to its cells after a heart attack?

This is still science fiction, but basic researchers are working to bring it closer to reality. As a first step, synthetic biologist **Pamela Silver** used an engineering approach to build a simple memory circuit in yeast cells.

Working with other Harvard University scientists, Silver constructed two genes from scratch—using bits of DNA that she stitched together with enzymes. Each of the genes contained instructions for making a type of protein called a transcription factor.

Transcription factors control gene activity—regulating how much or how little protein a gene makes. Silver created a feedback loop in which one protein switched on the other—and the cycle repeated—but only when very specific conditions were met.

By precisely setting the protein amounts, Silver created cellular "memory"—a system of working parts that behaved reliably and predictably in a particular situation. —*A.D.*

Scientists suspect that the flu virus vacations in the tropics.

Does Flu Fly South?

During flu season, we all know where the influenza virus spends its days and nights: hopping among unwashed hands and clinging to doorknobs, keyboards, and cell phones.

But where does the flu virus go in the off-season, during a North American summer? Does it lay low, "resting," waiting for warm temperatures or increased sunlight?

Or does it travel across the equator, visiting the tropics where it is warm year-round?

Biologist **Edward Holmes** of Penn State University tested the migration idea by comparing the DNA of flu viruses from New Zealand, Australia, and New York.

He discovered that the viruses were all pretty similar in their genetic makeup, suggesting that they spend time in the same place and trade bits of their genes.

Holmes thinks that place might be in the tropics—probably Southeast Asia—where animals and people live close to each other. The "vacation" likely allows viruses to mingle and exchange genetic material before heading off for new attacks on the human immune system the next winter. —*A.D.*

Gene-activity readouts may help determine an intensive-care patient's infection risk.

Rapid "Ribo" Readout

At the turn of the 20th century, doctors learned how to record electrical activity in the heart of a living person. Tracking this information over time led to electrocardiograms, now known as EKGs.

Fast-forward 100 years. Now, researchers have created a prototype of a "riboleukogram," which in a similar fashion tracks gene activity over time in a sick person's white blood cells, or leukocytes.

If the prototype's effectiveness can be confirmed in larger studies, riboleukograms may accurately signal infection changes in a critically ill patient just like EKGs indicate changes in heart function.

Intensivist **J. Perren Cobb** of Washington University in St. Louis and his team developed the new technology by collecting blood from intensive-care patients and measuring the activity of certain genes in their leukocytes.

A computer program then sorted the information into patterns that helped indicate a patient's likelihood of getting a severe type of pneumonia.

Rapid riboleukogram readout could be a powerful health tool for helping doctors intervene early, Cobb explains. That's because typical infection tests can take days—too long for many critically ill patients. —*A.D.*

These stories describe NIGMS-funded medical research projects. Although only the lead scientists are named, they work together in teams to do this research.